DOCUMENT RESUME

ED 433 185 SE 061 158

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TITLE Science Classrooms for Students with Special Needs. ERIC Digest.
INSTITUTION ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, OH.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO EDO-SE-98-05
PUB DATE 1998-02-00
NOTE 4p.
CONTRACT RI93002013
AVAILABLE FROM ERIC Clearinghouse for Science, Mathematics, and Environmental Education, 1929 Kenny Road, Columbus, OH 43210-1080.
PUB TYPE ERIC Publications (071) -- ERIC Digests in Full Text (073)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Disabilities; Educational Technology; Elementary Secondary Education; *Inclusive Schools; Laboratory Equipment; Mainstreaming; *Science Instruction; *Special Needs Students; Teacher Attitudes; Teaching Methods
IDENTIFIERS ERIC Digests

ABSTRACT

This digest summarizes research on teaching special needs students relative to the concerns of K-12 science teachers. Guidelines for instituting inclusive policies and practices are presented. Strategies for preparing science classroom materials and adapting teaching methods for students with physical and learning disabilities are also discussed, along with the importance of science teachers' attitudes toward special needs students. A brief list of Internet resources for educating special needs students is featured. (ASK)

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Legal resolutions, concerns of parents, and new research on learning and socialization have led to widespread efforts to place students wih special needs in regular classrooms, a practice known as *inclusion*. According to the report on Women, Minorities, and Persons with Disabilities in Science and Engineering (1996), approximately 6% of children in the United States were in federally-supported special educational programs during the 1992-1993 school year, up 1.5% from 15 years earlier. The number of disabled students participating in regular classrooms has risen by 10% during the last five years (Roach et al., 1997).

The manifestation of particular disabilities varies widely among students with special needs, but over half of the identified disabilities are learning disabilities. Other disabilities include speech and language difficulties, mental retardation, and serious emotional difficulties. Physical disabilities are relatively rare, constituting less than 2% of those identified as having disabilities (Women, Minorities, and Persons with Disabilities in Science and Engineering:1996, 1996).

The Consortium on Inclusive Schooling Practices (no date given) has developed a framework for evaluating state and local policies for inclusion "in an effort to help state and local policy makers, practitioners, and families determine if the general educational policies of their state or district support the inclusion of students with disabilities." The Consortium offers six policy goalst: (a) curricula that allow for maximum development of individual students; (b) measurable, alternative, appropriate assessment practices; (c) accountability for all members of the educational community; (d) commitment to professional development; (e) sufficient and responsible funding for programs; and (f) governance structures that allow for central support of localized control.

Effective Inclusive Climates

Rainforth (no date given) asserts that the best strategies for successful inclusion "parallel the best practices in general education reform and restructuring." She lists interdisciplinary instruction, team teaching, and block scheduling as the techniques most likely to promote success in meeting the needs of students with disabilities.

Special Needs and Science Classes

Science classes provide special needs students with opportunities they may not get anywhere else. Scruggs and Mastropieri (1994) reported that special education programs often lack the supplies and equipment necessary for science laboratory work, and special education teachers may not have the scientific expertise to comfortably teach the subject. It was further noted that "the benefits of concrete, real-world experiences, opportunities to work effectively in group situations, the excitement of scientific observation and experimentation, and alternative methods of evaluation" as reasons why science classes are ideal inclusion situations. Simons and Hepner (1992) add self-esteem for disabled students and the development of increased empathy, understanding, and leadership potential among nondisabled students as more reasons to support inclusive science classrooms.

Preparing the Classroom

"The [inclusive] instructor must play carpenter, interior designer, and adaptive technician" in the science classroom and laboratory (Weld, 1990). Experienced teachers indicate that lab benches, storage spaces, sinks and first aid stations are often not usable by students with physical disabilities. Because of their limited mobility, these students may also require additional aisle space, both within classrooms and along any corridors which may be part of emergency escape routes.

Students with disabilities may also require assistive technology. However, Sax et al. (no date given) reported that assistive technology resources are not always used when they could benefit students, citing lack of knowledge among teachers in choosing and using such supplies. They recommend attention to three matters when considering incorporating assistive technology in the classroom: (a) allow the student, his or her family, and classmates to help select assistive technology devices; (b) have a specific activity in mind when looking for a device, rather than simply purchasing an available device and figuring out what to do with it; and (c) seek help and advice from experts outside the field of education, including engineers, carpenters, and computer experts.

Adapting Curriculum and Assessment

In general, the strategies involved in adapting the curriculum for an inclusive situation will depend upon the needs of the individual students in a particular classroom. For example, students with learning disabilities often benefit from teachers making increased use of summary and pre-organizational techniques such as providing organizing notebooks, translating complicated directions or procedures into small blocks of information, handing out copies or outlines of class lecture notes, or posting weekly assignments in convenient places for students to examine (Simons & Hepner, 1992). Students with physical disabilities may need to sit toward the front of the classroom or develop special signals to indicate the need for communication.

In science classes, laboratory instruction may need to be significantly modified for students who have disabilities. As with lesson content, students with learning disabilities may require more organized information given in smaller increments. Students with physical disabilities, on the other hand, often require modified equipment or procedures in order to complete laboratory exercises. Weld (1990) suggested using a "lab buddy" who is paired with a disabled student, understands the student's limitations, and can work within that framework to do the lab *with* the disabled student rather than *for* him or her. Braille rulers can be purchased or made, or instruments that normally have visual output can be modified to have audio output. For students with hearing difficulties, lab equipment with sound signals can be wired to include a light or other visible signal as

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well (Roberts & Bazler, 1993). Microscopes which do not require small motor skills for fine adjustment can be purchased, or projection scopes can be used for students with visual impairments (Scruggs & Mastropieri, 1994). Finally, no student in science class should be exempt from lab safety rules, so teachers may need to frequently model appropriate safety behavior and give students chances to practice reacting to staged "crises."

Assessment options for the inclusive classroom should reflect the diverse skills and goals of students in the class. Jorgensen (1997) suggests using frequent assessment checks to determine progress, allowing students to demonstrate their learning through varied modes of expression, and having students complete unit projects which allow for synthesis of individual strengths and interests with specific content learning.

Again, individual needs will dictate how particular lessons, labs or assessment options may have to be modified to enable all students to reach their full potential. Taking advantage of a special education teacher's or parent's expertise about a particular student is often a productive means of determining what strategies would work well in a given situation (Weld, 1990). Experienced science teachers in inclusive classrooms stress that involving a student's classmates in devising ways to adapt lessons to individual student needs is often a strikingly successful process (Richardson, 1994; Weld, 1990). Educational or professional organizations may also be able to provide access to more specific examples of other teachers' positive experiences with inclusion in science class.

Inclusion and Teacher Attitude

Nearly three hundred disabled adults were interviewed by the American Institutes for Research and the American Association for the Advancement of Science, and many of them indicated that some "critical incident...either encouraged or discouraged them from considering science as an area of interest or particular discipline they could reasonably pursue." Not surprisingly, teachers were often the catalyst of this critical incident—the most frequently-cited reason for the disabled interviewees choosing a career in science was teacher behavior (Weisgerber, 1990). Above and beyond the revised lesson plans and alternative assessment strategies, perhaps the most critical aspect of involving disabled students in the classroom is that teachers realize the significance of their attitudes and expectations toward students with special needs. Such students must know that science is for them, too. Richardson (1994) expressed this idea another way: "Excusing a special needs student from a classroom assignment is simply excusing yourself from finding a way for the student to participate in the assignment."

One problematic attitude is the feeling that addressing the needs of individual students compromises the notion of "fairness." As Stefanich (1994) pointed out, "At an early age...students develop a belief system that equal treatment is fair treatment. A utilitarian view, what is best for the majority is best for everyone, is often a very permeating orientation in the classroom." However, fairness can also be viewed as treating equals equally and unequals unequally. All students can participate in some way in the science classroom, even if it is not the same way. Jorgensen (1997) outlines a successful inclusion strategy which organizes content around central themes, issues or problems, and allows students to meet educational objectives in various ways most conducive to individual strengths and needs. Such a strategy is helpful to and appropriate for every student in the classroom, not just those with disabilities. To be sure, teaching an inclusive science classroom effectively involves a commitment to the needs of all students, and all students can benefit from the process.

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Resources on the World Wide Web

ERIC Clearinghouse on Disabilities and Gifted Education
http://www.ced.sped.org/ericec.htm

The National Information Center for Children and Youth with Disabilities
http://www.nichcy.org/

Consortium on Inclusive Schooling Practices
http://www.asri.edu/cfsp/brochure/abtcons.htm

Circle of Inclusion
http://circleofinclusion.org/

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This digest was funded by the Office of Educational Research and Improvement, U.S. Department of Education under contract no. RI-93002013. Opinions expressed in this digest do not necessarily reflect the positions or policies of OERI or the Department of Education.

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